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(56) Documents Cited

GB 2291683 A JP 040025621 A US 4568131 A
US 4125298 A

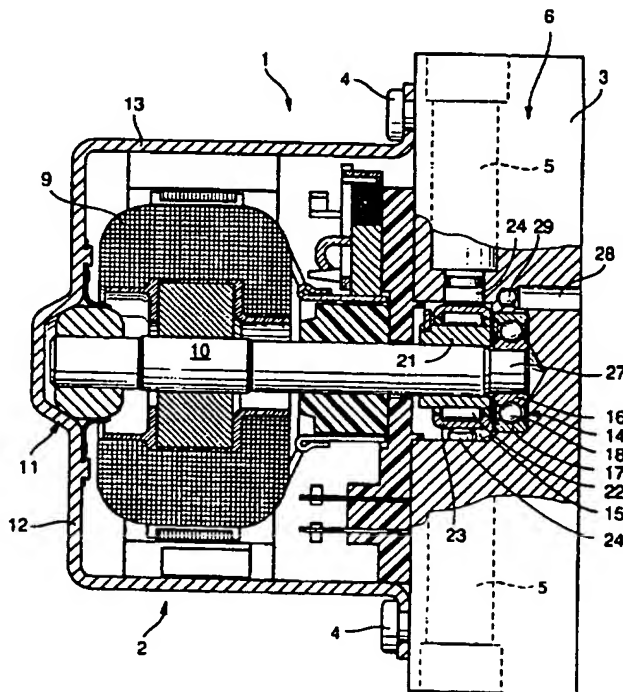
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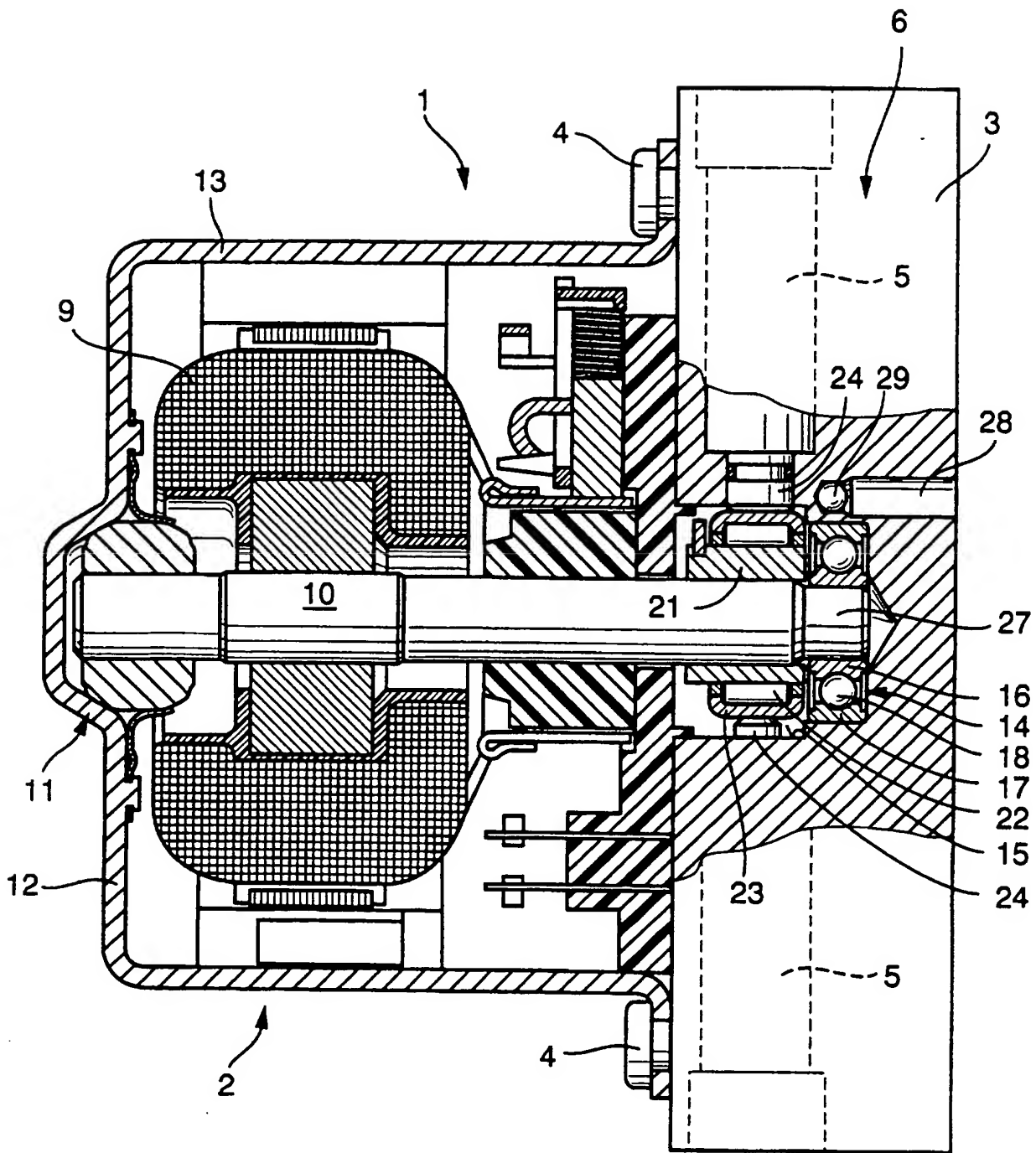
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(54) Abstract Title

Pump unit bearing arrangement

(57) A pump unit (1) has a radial piston pump (6) with at least one pump piston (24) in a pump block (3), and also has a driving motor (2) attached to the said pump block. A shaft (10) can be driven by the driving motor (2) and, in turn, drives the pump piston (24). The shaft (10) is mounted in a housing (13) belonging to the driving motor (2) with a first bearing (11), and in the pump block (3) with a second bearing (14) at that shaft end (27) which is on the pump piston side. The second bearing (14) is a fixed bearing, whose outer race (17) is inserted in the pump block (3) with a clearance fit and is held in a non-twistable and axially non-displaceable manner by the displacement of material belonging to the pump block (3) against the periphery of the said outer race (17). The displacement of pump block material may be caused by pressing a body such as a ball (29) into a bore (28) in the housing (13).





Pump unit

Prior art

The starting point of the invention is a pump unit of the kind in patent claim 1.

- A pump unit of this type is already known, in which an eccentric, which serves to drive pump pistons, and a rotor belonging to the driving motor are disposed between
5 two bearings on a shaft (US 4 568 131). Because of the disposition of the eccentric immediately adjacent to the second bearing of the shaft, little deflection of the shaft occurs, resulting in low emission of noise. However, this advantage is diminished if the second bearing, which is on the pump piston side, is a loose bearing.
- 10 In the case of pump units, for example for slip-regulated braking installations in motor vehicles, the disposition, in a bore in the pump block with a press fit, of a rolling bearing mounted on the shaft in a non-separable manner, instead of the loose bearing, has hitherto been avoided when the outer race of the bearing is inaccessible to a pressing-in tool and the pressing-in force can be transmitted to the outer race of the
15 bearing only via the shaft, the inner race of the bearing, which inner race is pressed onto the shaft, and the rolling bodies. In a known pump unit, therefore, a fixed bearing on the pump piston side is pressed into a bearing shield belonging to the driving motor and adjoining the pump block, while a loose bearing is provided on a base wall of the motor housing that faces away from the said pump block. The
20 eccentric is disposed, in an overhung manner, on that end section of the shaft which engages in the pump block (DE 196 42 133 A1). In another known pump unit, in order to reduce the bending stress on the end section of the shaft, the said shaft is prolonged beyond the eccentric and mounted in the pump block with the aid of another loose bearing (DE 44 44 646 A1). Apart from overdetermination of the shaft

bearings, however, this measure makes mounting of the pump unit more difficult, and makes the said unit more expensive.

Advantages of the invention

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Compared with the above, the pump unit according to the invention having the features in patent claim 1 has the advantage that the second bearing can be mounted in a simple manner like a loose bearing and can be fixed in position by means of another working step, so that, in its end position, it is able to perform the function of a fixed bearing. As a result of this, the behaviour of the pump unit in respect of noise is improved, in the sense that the latter is reduced, with little outlay. In addition, the possibility of disposing the second bearing, which is inaccessible from the driving motor side, at a greater or lesser depth in the pump block results in a degree of latitude, design-wise, in respect of the positioning of the radial piston pump in the pump block and the maximum diameter of the said pump.

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Advantageous further developments of, and improvements to the pump unit described in patent claim 1 are provided by the measures set out in the subclaims.

Thus, the measure according to claim 2 may be sufficient for a lightly stressed fixed bearing. In order, however, to keep deformation of the outer race of the bearing low and/or to be able to absorb high axial forces on the bearing, it is particularly advantageous to effect displacement of material belonging to the pump block at numerous points on the periphery of the bearing or on the periphery as a whole.

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In accordance with the further development of the invention according to claim 3, the bearing may advantageously be secured in position in a carefully directed manner,

particularly if it is disposed in the pump block a relatively long way from an outer face of the said block.

The aim of the measure characterised in claim 4 is to achieve displacement of material
5 precisely at the desired point.

The bore is expediently disposed in the pump block in the manner indicated in claim
5.

10 The bodies mentioned in claim 6 are suitable, in an advantageous manner, as means for achieving the displacement of material.

Drawing

15 An exemplified embodiment of the invention is represented in simplified form in the single figure in the drawing with the aid of a longitudinal section through a pump unit, and is explained in greater detail in the following description.

Description of the exemplified embodiment

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A pump unit 1 which is represented in the figure in the drawing comprises an electric driving motor 2 which is disposed on a lateral face of a pump block 3 and fastened to the latter with screws 4. Two pump elements 5 belonging to a radial piston pump 6 are disposed in the pump block 3.

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The driving motor 2 has a shaft 10 which carries a rotor 9 and is rotatably mounted at both ends. A first bearing 11 is disposed on a wall 12 at the base end of a pot-shaped housing belonging to the driving motor 2. The first bearing 11 is configured as a plain

bearing and forms a loose bearing for the shaft 10. A second bearing 14 belonging to the shaft 10 is situated in a stepped bore 15 in the pump block 3. The said second bearing 14 is configured as a rolling bearing having an inner race 16, an outer race 17 and rolling bodies 18 disposed between the two races, and forms a fixed bearing for
5 the shaft 10.

Immediately adjoining the second bearing 14, an eccentric sleeve 21 is fitted onto the shaft 10 with a press fit. The said eccentric sleeve 21 carries a needle bearing 22, on whose outer race 23 pump pistons 24 belonging to the two pump elements 5 of the
10 radial piston pump 6 are supported. By means of the eccentric sleeve 21 and the needle bearing 22, the pump pistons 24 can be driven in an oscillating manner with the shaft 10, which is set in rotating movement by the driving motor 2.

The following measures are adopted for arranging and mounting the second bearing
15 14 in the pump block 3:

The inner race 16 of the second bearing 14 is disposed, with a press fit, on that shaft end 27 of the shaft 10 which is on the pump piston side. On the other hand, the fit of the outer race 17 of the second bearing 14 in the bore 15 in the pump block 3 is
20 designed as a clearance fit. When mounting the driving motor 2 on the pump block 3, therefore, the second bearing 14, which is seated on the shaft 10 in a non-separable manner, can be inserted in the bore 15 like a loose bearing.

In the exemplified embodiment represented, a bore 28, which extends parallel to the
25 axis of the second bearing 14, emanates from that side of the pump block 3 which faces away from the driving motor 2. After a reduction in diameter, the said bore terminates in the peripheral region of the outer race 17 of the second bearing 14. A ball 29 is inserted in the bore 28. The ball 29 has a diameter which is larger than that

section of the bore 28 which is on the outer race side, but smaller than the remaining part of the said bore. The ball 29 is therefore pressed into that section of the bore which is on the outer race side. In the process, displacement of material belonging to the pump block 3 against the periphery of the outer race 17 of the second bearing 14 is achieved. The consequence of this displacement of material is that the outer race 17 is held in the bore 15 in the pump block 3 in a non-twistable and axially non-displaceable manner. The second bearing 14 is thereby able to assume the function of a fixed bearing for the shaft 10 of the driving motor 2. In this way, defined mounting of the shaft 10 is achieved.

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In a manner differing from the exemplified embodiment, two or more bores 28 may be disposed in the pump block 3 concentrically with, and uniformly distributed around, the outer race 17 of the second bearing 14. As a result of this, the loading of the outer race 17 of the second bearing 14 by forces brought about by the displaced material can be made uniform. Instead of the ball 29 pressed into the bore 28, use may also be made of other displacing bodies, for example cylindrical bolts. Moreover, in the case of a cast pump block 3, it is also possible to provide, instead of the bore 28, recesses of a different cross-section into which matching displacing bodies can be pressed. In order to minimise the weight of the pump unit 1, a working procedure in which a displacing body in the form of a ram can be pressed into the bore 28 and then withdrawn from the latter after the displacement of material has been effected, is also suitable for securing the outer race 17 of the second bearing 14 in position in the pump block.

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Claims

1. Pump unit (1) having a radial piston pump (6) having at least one pump piston (24) in a pump block (3), having a driving motor (2) attached to the said pump block (3), and having a shaft (10) which can be driven by the driving motor (2) and which drives the pump piston (24), the said shaft (10) being mounted only with a first bearing (11) in a housing (13) belonging to the driving motor (2), and in the pump block (3), at that end (27) of the shaft which is on the pump piston side, with a second bearing (14) constructed as a rolling bearing,
5 characterised in that
the second bearing (14) is a fixed bearing whose outer race (17) is inserted with a clearance fit in the pump block (3) and is held against the periphery of the outer race (17) in a non-twistable and axially non-displaceable manner by the displacement of material belonging to the pump block (3).
10
2. Pump unit according to claim 1, characterised in that material
15 belonging to the pump block (3) is displaced against the periphery of the outer race (17) of the bearing at at least one point.
3. Pump unit according to claim 2, characterised in that the pump block (3) has at least one recess (28) which leads into the peripheral region of the outer race (17) of the bearing and into which a displacing tool can be introduced or a displacing body (29) is pressed.
20
4. Pump unit according to claim 3, characterised in that the recess is a bore (28) which has, only in the peripheral region of the outer race (17) of the bearing,
25 a cross-section which is smaller than that of the displacing tool or displacing body.

5. Pump unit according to claim 4, characterised in that the bore (28) emanates from a side of the pump block (3) facing away from the driving motor (2), and extends parallel to the axis of the second bearing (14).
- 5 6. Pump unit according to claim 3, characterised in that the displacing body is constructed as a ball (29), bolt or the like.
7. A pump unit substantially as herein described with reference to the accompanying drawings.

Amendments to the claims have been filed as follows

1. A pump unit comprising a radial piston pump which includes at least one pump piston mounted in a pump block, a driving motor attached to the said pump block, and a shaft which which drivingly connects the driving motor to the pump piston, the shaft having a first motor end which is mounted in a first bearing carried in a housing of
5 the driving motor and a second pump end which is supported in a second rolling type bearing mounted in a bore formed in the pump block, wherein the pump block includes at least one recess which extends to the peripheral region of the outer race of the second bearing, into which a deforming body is insertable so as to effect plastic deformation of the material of the pump block towards said second bearing, thereby to retain the bearing
10 in the pump block in a non-twistable and axially non-displaceable manner.
2. A pump unit according to claim 1, wherein the or each recess is a bore which has, only in the peripheral region of the outer race of the bearing, a cross-section which is smaller than that of the deforming body.
15
3. A pump unit according to claim 1 or claim 2, wherein the or each bore emanates from a side of the pump block facing away from the driving motor, and extends parallel to the axis of the second bearing.
- 20 4. A pump unit according to any of the preceding claims, wherein the deforming body is constructed as a ball or a bolt.
5. A pump unit according to any of the preceding claims, wherein the deforming body, once inserted into the recess, is retained therein.

6. A pump unit according to any of the preceding claims, wherein the pump block includes a plurality of recesses distributed about the periphery of the second bearing.

7. A method of fixing a rolling bearing in a pump block of a pump unit
5 according to any of the preceding claims, comprising the steps of inserting the rolling bearing into a bore in the pump block which is sized so as to be a clearance fit, and inserting a deforming body into at least one recess which is formed in the pump block and which extends to the peripheral region of the rolling bearing, thereby plastically deforming the material of the pump block against said periphery of the outer race so as
10 to lock the rolling bearing in the bore in a non-twistable and axially non-displaceable manner.

8. A pump unit substantially as herein described with reference to the accompanying drawing.

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9. A method of fixing a rolling bearing in a pump block of a pump unit substantially as herein described with reference to the accompanying drawings.



INVESTOR IN PEOPLE

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Examiner: Robert Crowshaw
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Patents Act 1977 Search Report under Section 17

Databases searched:

UK Patent Office collections, including GB, EP, WO & US patent specifications, in:

UK Cl (Ed.R): F1W (WCT); F2A (AD19)

Int Cl (Ed.7): F04B 1/04, 1/053, 17/03, 53/00, 53/22; F16C 35/04, 35/06, 35/07, 35/073, 35/077

Other: Online databases: EPODOC, JAPIO, WPI

Documents considered to be relevant:

Category	Identity of document and relevant passage	Relevant to claims
Y	GB 2291683 A (MERCEDES-BENZ) Note the sleeve 2 which is shrink-fitted onto the outer race 4 of the bearing 12.	1, 2
Y	US 4568131 (BLOMBERG) A radial piston pump and motor having a shaft supported by a pair of bearings.	1, 2
Y	US 4125298 (HEURICH) See column 2 lines 34-64 and figure 2 for the bearing retained by plastic deformation of the housing.	1, 2
Y	JP 040025621 A (FUJITSU) 1992. See the JAPIO abstract and note in figures 1 and 2 the displacing annular member 10 which is inserted into the annular recess 9 in the hub 1 surrounding the rolling bearing 2.	1-3

X Document indicating lack of novelty or inventive step
Y Document indicating lack of inventive step if combined with one or more other documents of same category.

& Member of the same patent family

A Document indicating technological background and/or state of the art
P Document published on or after the declared priority date but before the filing date of this invention.
E Patent document published on or after, but with priority date earlier than, the filing date of this application.